Purpose and performance of measurement systems

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1. Purpose and performance of measurement systems

We begin by defining a process as a system which generates information. Examples are a chemical reactor, a jet fighter, a gas platform, a submarine, a car, a human heart, and a weather system. Table 1 lists information variables which are commonly generated by processes: thus a car generates displacement, velocity and acceleration variables, and a chemical reactor generates temperature, pressure and composition variables.

measured variables.1	**measured variables.2**	**measured variables.3**
Acceleration	Density	Current
Velocity	Humidity	Voltage
Displacement 3	pH	Power

Table 1: Common information/measured variables.

1.1. Subsection 0ne

We then define the observer as a person who needs this information from the process. This could be the car driver, the plant operator or the nurse. The purpose of the measurement system is to link the observer to the process, as shown in Figure 1. Here the observer is presented with a number which is the current value of the information variable. We can now refer to the information variable as a measured variable. The input to the measurement system is the true value of the variable; the system output is the measured value of the variable. In an ideal measurement system, the measured

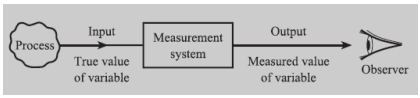

Figure 1: Purpose of measurement system.

2.

value would be equal to the true value. The accuracy of the system can be defined as the closeness of the measured value to the true value. A perfectly accurate system is a theoretical ideal and the accuracy of a real system is quantified using measurement system error E, where

$$E = measuredvaluetruevalue \tag{1}$$

Thus if the measured value of the flow rate of gas in a pipe is 11.0 m3/h and the true value is 11.2 m3/h, then the error E = 0.2 m3/h. If the measured value of the rotational speed of an engine is 3140 rpm and the true value is 3133 rpm, then E = +7 rpm. Error is the main performance indicator for a measurement system. The procedures and equipment used to establish the true value of the measured variable will be explained in Chapter 2.